



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

REVIEWS

THREE PHASES OF MODERN PALEONTOLOGY

- I. *Uintacrinus: Its Structure and Relations.* By FRANK SPRINGER. (Mem. Mus. Comp. Zoöl., Vol. XXV, pp. 1-90, 8 pls., Cambridge, 1901.)
- II. *Oriskany Fauna of Becraft Mountain.* By JOHN M. CLARKE. (Mem. New York State Mus., Vol. III, No. 3, 128 pp., 9 pls., Albany, 1900.)
- III. *Stratigraphical Succession of the Fossil Floras of the Pottsville Formation in the Southern Anthracite Coal Field.* By DAVID WHITE. (U. S. Geol. Surv., Twentieth Ann. Rept., Part 11, pp. 749-930, 13 pls., Washington, 1901.)

Three notable contributions to our knowledge of fossil organisms have lately appeared from the hands of the printer. They are notable as making distinct advancements in paleontology. They are notable as typifying the three distinct phases into which the science relating to ancient life has finally resolved itself. They are notable as model works of their kind, each representing the general subject from a very different viewpoint, and hence show very diverse modes of treatment and the very diverse character of paleontological inquiry of today.

1. The crinoids have long been an attractive theme to geologists. Ever since the discovery by Marsh, in 1870, of the remarkable Cretaceous crinoid afterward called *Uintacrinus*, great interest has been taken by paleontologists in each new accession. Grinnell, Meek, Willison & Hill, in this country, and in Europe, Schlüter and Bather, have described carefully the known material. It has remained for Mr. Springer, so long intimately associated with the lamented Wachsmuth, to give us a magnificent monograph on the subject, including a large amount of new information derived from rich, lately discovered material. And this after one would naturally think that about all that it was possible to say had been said.

The special charm and value in this work is the strictly morphological character that it presents. In this respect it fully keeps up the

same high standard of excellence that made the *North American Crinoidea Camerata* of Wachsmuth & Springer so acceptable to all students of fossil organisms.

Unusual interest centers in the composition of the base of *Uintacrinus*. A feature that has long been regarded as fundamental in the separation of the larger taxonomic groups is here found in one and the same species. "Considering the apparent identity of these forms in every other point of structure, coupled with their mode of occurrence and association, I do not see how such association [as made by Mr. Bather] can possibly be made in this case. We therefore have apparently to deal with a case of individual variation as to this supposed primitive character, within the limits of a species. That is to say, in this species, living in the same locality, having the same environment, floating in the same mass, certain individuals matured to represent one stage of larval development, *i. e.*, with infrabasals; and others in another stage, *i. e.*, with basals only.

In short, there are the two supposed distinct types, *Monocyclica* and *Dicyclica*, occurring in both young and adult of one and the same species. It will not do to say that the species is dicyclic, but in certain individuals the infrabasals are not developed, or are hidden by the centrale, or have disappeared by atrophy. If this were so, the centrale ought to be interradian in both cases; whereas, as already shown, its orientation is reversed from one to the other, precisely as in the typical monocyclic and dicyclic forms.

Such a condition is believed to be unique among the crinoids. The bearing upon certain recently proposed classifications of the crinoids is also important. Bather and Jaekel have both severely criticised Wachsmuth & Springer's classification and have erected schemes that are "sought by the modern biologist."

"There is no doubt," says Mr. Springer, "that each author who undertakes to express his ideas of descent in a new scheme of classification does so in the belief that his own structure is a substantial pyramid whose base is firmly established upon the ruins of the top-heavy contrivances of his predecessors. With regard to the crinoids, there have appeared, since our monograph of the *Camerata*, two elaborate classifications, each avowedly based upon phylogenetic principles, *viz.*, that of Mr. Bather, already mentioned, and one by Dr. Jaekel, whose general researches and great works upon the crinoids of Germany constitute a rich contribution to science. The views of the latter author are to be developed in full detail in his magnificent

"Stammesgeschichte der Pelmatozoen," the first part of which, embracing the Thecoidea and Cystoidea, has just been published. He, likewise, finds fault with Wachsmuth & Springer, because, in his opinion, they have dealt with the morphological conditions as they found them too much from an anatomical standpoint, and have not sufficiently taken into account the import of the modifications due to descent. He finds in the changes in the systematic arrangement of the crinoids made by Wachsmuth & Springer in their successive writings, proof that the right road to the solution of the great questions of classification had not yet been found. We have, therefore, two new and almost simultaneous phylogenetic classifications, by two of the most eminent living authorities, both predicated in part upon the insufficiencies of Wachsmuth & Springer's system, and each believed by its author to be a new and correct reading of the race history of the crinoids. From such sources, and following such a preface, we should not unnaturally expect a brilliant illumination of the road, in search of which their predecessors have floundered in darkness. But to our dismay we find that instead of celebrating a conclusive settlement of these questions, we are only invited to witness fresh controversy. For these new chroniclers do not read their history alike, and their two classifications are about as diametrically and fundamentally opposite as anything could be."

Uintacrinus presents a striking resemblance to the living crinoid *Actinometra* in the eccentric position of its mouth, the central position of the anus, the absence of any calcified ambulacral skeleton on disk, arms and pinnules, the structure and distribution of the disk ambulacra, the form and proportions of brachials, and distribution of syzygies, the variable size of the anal tube, and the instability of the base.

The systematic position of Uintacrinus will be a matter of controversy for a long time to come. As yet hardly any two authorities agree in placing it in the same position.

Wherever it may belong, and whatever its line of descent, there is no doubt that Uintacrinus is both a protean and convergent form more remarkable than any we have hitherto encountered among the crinoids. Along with great variability in the base and interbrachial regions, it combines:

The interbrachial system and fixed pinnules of the Camerata;

The pliant test of the Flexibilia;

The large visceral cavity of both of these;

The exocyclic disk and open ambulacra, and the arms, pinnules, and syzygies of Actinometra;

The free-floating character of the Comatulæ;

The dicyclic base of the Dicyclia;

The monocyclic base of the Monocyclia.

A noteworthy feature that should receive special mention in connection with this monograph is the distribution of study material, illustrating the points and structures discussed, to some of the principal museums. It is a feature that could well be imitated by other workers in paleontology. In this way the principal type specimens have been deposited in the Museum of Comparative Zoölogy. A large slab has been placed in the National Museum at Washington; it contains specimens exhibiting most of the characters discussed. A fine series of specimens have also been sent to the British Museum, and to the Royal Museum of Natural History at Berlin, where they will be accessible to European students.

2. As stated by Dr. Clarke, in his prefatory note to the *Oriskany Fauna of Becraft Mountain*, the original purpose of his work was solely to depict the character and composition of the Oriskany fauna of Becraft Mountain, which of itself displays many features of interest. In its progress, however, various questions have arisen which concern the intrinsic value of the fauna and its importance in correlation. Yet without an understanding of the fauna itself it would be impracticable to discuss the latter problems, and for this reason the title of the paper is restricted to the principal argument of the work, to which the discussions of a somewhat broader scope are corollaries.

A fauna which finds its highest development at Becraft Mountain, near Hudson, in Columbia county, N. Y., links together in the character of its species, the calcareous shales and limestones of the Lower Helderberg and the normal Oriskany sandstone.

The interesting bearings of this assemblage of species, its new forms and new associations and its real importance in the correlation of the Lower Devonian are sufficient reason for presenting its characteristics in detail.

A brief account of the stratigraphy of the mountain is given, and also the general New York section as recently revised. Accompanying these is a small geological sketch-map of the Becraft Mountain syncline.

The greater portion of the memoir is devoted to the description of species, which are finely illustrated by nine plates of figures. A table of the vertical range of species occurring in the region is given.

With our present knowledge there are thus 113 recognizable, distinct specific forms in the fauna of the Oriskany at Becraft Mountain, and of these 94 are identifiable with species already known or are clearly new forms peculiar to the fauna. Of the 94, 25 preceded the introduction of the Oriskany sedimentation, having been first described from the fauna of the Helderbergian. In the arenaceous beds of the Oriskany 23 occur; 10 range upward into the faunas of the Upper Helderberg (Ulsterian), but a part of these are restricted to the sandy, lower beds of this formation (Schoharie grit), and others have been noted only in the chert beds of Ontario, Canada, where the intermixture of Oriskany and Onondaga species is well marked and has been recorded by Schuchert. The fauna contains 35 species which so far as known are peculiar to it. On farther analysis of the table, it is evident in some cases that species which range down and upward are restricted to particular groups. Thus the alien trilobites are from the Helderbergian; the gasteropods are exclusively Oriskany; while the alien lamellibranchs are mostly Helderbergian. But the leading factor of the fauna, the brachiopod, has its derivation as freely from below as in the Oriskany invasion.

The faunal values of the different species are then summed up.

Concerning the nature of the Oriskany fauna of New York, the author says:

The fauna of the calcareous Oriskany is in no sense a mixed assemblage, or an intermingling of faunas of adjacent provinces. The sequence of life has continued without interruption from the Helderbergian (Kingston beds) into the sediments of the Oriskany and Onondaga limestone.

It is extremely probable that important variations from the fauna of the Catskill shaly (New Scotland) limestone had already made their appearance in the Becraft limestone, and that we first become acquainted with some of these in the study of the calcareous Oriskany. No proof therefore could be adduced more emphatically confirmatory of the intimate faunal relations of the Helderbergian with the Oriskany fauna and its successors than the facts brought forward in this paper.

The fauna discussed is that of the calcareous facies of the Oriskany formation. The sedimentary deposits of this and the neighboring sections were essentially limestones notwithstanding the silicious content, whether diffused through the mass or segregated as cherty secondary product. In the earlier presentation of this fauna it was regarded as of lower Oriskany horizon on account of the presence of many Helderbergian species, but we believe it will be more correctly construed as the representative of the proper and normal Oriskany fauna, the true fauna of this time-unit inclosed in the sediments of its proper habitat.

A chapter is devoted to discussing the Devonian age of the Helderbergian fauna and the base of the Devonian system in New York.

The fact of the presence of numerous Helderbergian species in the fauna of the Oriskany of Becraft Mountain, as an integral part of that fauna, not a casual intermixture, is sufficient demonstration that the fauna of the Helderbergian became modified in its continued existence by the departure or extinction of certain of its species only. A fair percentage kept the field up to the time of and pending the incursion of species of the early Oriskany. In this way the former became a true and proper part of this new fauna with whose indicial species it coexisted throughout the remainder of its duration. A modification so gradual as to permit such an uninterrupted existence cannot sever the close relation of the one fauna in its entirety to the other. It is therefore a natural corollary from the account given of the Oriskany fauna, to consider briefly the relation of the organic assemblage constituting the typical and normal Helderbergian to the Devonian type of organic life, and that formation in its relation to the Devonian system.

Arguments are adduced from the intrinsic characters of the fauna, from correlation, and from stratigraphy.

3. Of very different nature is Mr. White's work on the plants of the Pennsylvania Coal-measures. The stratigraphical interval which he considers is occupied by the Pottsville formation, Pottsville series, or Pottsville conglomerate. It is described as a series of largely arenaceous beds of variable thickness which in eastern Pennsylvania lies between the Maunch Chunk red shale, or distinctly Lower Carboniferous, and the lower productive Coal-measures, or distinctly Upper Carboniferous.

The investigation was intended to establish three propositions: (1) The exploitation and elaboration from, a stratigraphic standpoint, of the fossil plants of the Pottsville formation in the type region of the southern anthracite coal field; (2) the critical analysis and comparative study of the plant material collected, with a view to the discovery of the existence of any natural paleontological subdivisions, zones, or horizons, and their paleontologic characters, or the species of stratigraphic value; (3) the discovery of the paleontologic limits as differing or as agreeing with the lithologic limits of the type section, and the consequent paleontologic definition of the formation.

The main aim of the investigation is the paleontologic definition of the terrane.

Two other, largely concomitant, results that are either economic or scientific in their nature have also been reached in the process of the elaboration of the fossil plants of the formation in the typical region. The first, of some economic interest, is the correlation of the groups of beds, or of individual

coals wrought in disconnected or somewhat isolated portions of the southern anthracite field. The other, which concerns the question of general geological correlation, is the acquisition of data for the determination of the age of the Pottsville formation—*i. e.*, (*a*) the time interval represented by the type section, and (*b*) the equivalents, in a broad sense, of the formation in other basins of this province and in other parts of the world. Incidentally also, through the discovery in the Pottsville of floras already more or less completely known from isolated and uncorrelated terranes in other regions of the United States, the way is opened to the proper reference and correlation of those terranes with the Pottsville, or with portions thereof.

As introductory to the consideration of the plant remains as a means of geological classification there are presented a sketch of the general geological structure of the southern anthracite coal field, a description of the Pottsville formation in the typical locality, the composition of the formation, the coals contained, and their commercial names as guide horizons.

A type paleobotanic section of the Pottsville is then discussed, and the groupings of beds are enumerated. The various species and their observed distribution within the formation and in the field is given in detailed tabulated form, in which all the species are listed, together with their respective ranges. The floras of the several subdivisions indicated are discussed in some detail. The correlative comparison of the horizons of the southern field with those of the other anthracite fields is of special interest.

A considerable portion of the memoir is devoted to the description of the most characteristic species of plants found in the Pottsville, and to notes on many other species.

One of the most surprising, as well as interesting, facts observed in the study of the Pottsville floras is the large element that is common in the latter and to the flora described by Sir William Dawson from the supposed Middle Devonian beds of St. John, New Brunswick. In fact, taking into view the entire flora of the Pottsville formation in the Appalachian province, the identities in the composition of the floras are so great, with respect to both genera and species, as to leave little room for doubt that we have in the "Fern Ledges" at St. John beds of nearly the same age as the Pottsville formation in Pennsylvania. On the whole, while recognizing in the Pottsville formation a group of terranes equal in rank to the Lower Coal-measures, Alleghany series, etc., I do not favor a classification which relegates the entire formation hard and fast to the Upper Carboniferous, but I even anticipate a possible necessity for its permanent division into two groups, the lower

of which may eventually perhaps be referred to the Lower Carboniferous. From a paleobotanic standpoint the Pottsville formation is the beginning of Mesocarboniferous.

Briefly stated, the following are some of the general conclusions reached :

No evidence of a marked or general unconformity between the Pottsville and Mauch Chunk is noticeable in this region, though at various points within several hundred feet of the strata beds of small boulders or coarse conglomerates are imposed, in knife-edge contact, on the distinctly uneven surfaces of olive-green mud-beds.

The flora in the roof of the Buck Mountain coal, or its supposed equivalents, at the base of the Lower Coal-measures at Pottsville is a typical Coal-measures flora, very distinct from the floras typical of the Pottsville formation.

The fossil plants of the Pottsville formation in the type region exhibit a rapid development and series of changes or modifications, which, if treated with great systematic refinement, are of high stratigraphic value. With the exception of the species from the topmost beds of the formation, the ferns are, in general, readily distinguished specifically from those at the base of the Lower Coal-measures, or Alleghany series, as recognized in the northern United States, while the floras of the lower portions of the section are found, in passing downward, to bear still less resemblance to those of the Lower Coal-measures. Two principal divisions of the formation, to which comparatively few fern species are common, are recognized. These divisions, which coincide with the natural grouping of the Lykens coals, are here termed the Lower Lykens division and the Upper Lykens division. A portion, including about two hundred feet of the type section between these two paleontologic divisions, contains a mixed flora, and has been temporarily designated the Lower Intermediate division.

Further paleontologic study of the Pottsville formation appears to fully confirm the earlier conclusion, based on the examination of the plants, that the thinner sections of the formation along the northern and western borders of the Appalachian trough do not contain beds as old as those in the lower portion of the thick sections along the eastern border, *e. g.*, in the Schuylkill and Great Flat Top regions. The positions of the respective floras in the sections plainly indicate a transgression of the sea toward the north and west during Pottsville time.

Both lithologically and paleontologically the Pottsville formation constitutes a division of the Carboniferous coördinate with the Lower Coal-measures, Alleghany series, etc. As such it forms the lower member of what may in a broad sense, be termed the Mesocarboniferous in the Appalachian province.

The lowest beds in the thickest sections, which appear to be continuous by transition with the deposition of the Maunch Chunk red shales, are perhaps to be regarded as coarse, coast-detrital redepositions, contemporaneous with the uppermost beds of the red shale or marine Lower Carboniferous sediments of other regions.

The flora of the Pottsville formation is so far identical, in both its generic and its specific composition, with that from the supposed Middle Devonian beds at St. John, as to leave no room for a great difference in the age of the latter.

CHARLES R. KEYES.

Iowa Geological Survey; SAMUEL CALVIN, State Geologist; A. G. LEONARD, Assistant State Geologist; Annual Report for 1900 (Vol. XI, 519 pages, 12 plates, 43 figures, 9 maps. Des Moines, 1901).

In scope and style this report follows closely the previous volumes of the series. It includes the usual administrative reports, the statistical reports of the mineral production, and detailed reports on Louisa, Marion, Pottawattamie, Cedar, Page, and Clay and O'Brien counties, the last two being treated together. These reports are written by J. A. Udden, B. L. Miller, J. A. Udden, W. H. Norton, Samuel Calvin, and T. H. Macbride respectively. They contain a careful review in each case of the local geology and serve to put on record facts and observations which may be used in later discussion of the theoretical problems involved. Following the usage of the survey, these discussions are taken up as fast as the development of the general survey allows them to be intelligently discussed. In the case of Louisa county, for example, the problems of the drift of that region have already been discussed in their theoretical phases in Mr. Udden's report on Muscatine county, Mr. Norton's report on Scott county, and Mr. Leverett's well-known monograph.¹ In the Louisa report Mr. Udden gives many interesting and valuable details confirmatory of the

¹ U. S. Geol. Surv., Mon. XXXVIII. The Illinois Glacial Lobe.